

SECRET  
(When Filled In)

REVISED

R & D CATALOG FORM		DATE
1. PROJECT TITLE/CODE NAME Sine-Wave Testing Equipment		2 November 1965
2. SHORT PROJECT DESCRIPTION The project involves the development of a device for field measurements of optical system performance.		
3. CONTRACTOR NAME 25X1A	4. LOCATION OF CONTRACTOR	
5. TYPE OF CONTRACTOR Manufacturer	6. TYPE OF CONTRACT CPIF (Cost and performance incentives)	
7. FUNDS 25X1A	8. REQUISITION NO.	9. BUDGET PROJECT NO. NP-IA-3
10. EFFECTIVE CONTRACT DATE (Begin - end) 15 Nov 65 - 15 May 66	11. SECURITY CLASS. AA - Confidential T - Unclassified W - Unclassified	
12. RESPONSIBLE DIRECTORATE/OFFICE/PROJECT OFFICER TELEPHONE EXTENSION DDI/NPIC/P&DS /2476 25X1A		
13. REQUIREMENT/AUTHORITY A portable device of high precision is needed by P&DS technical monitors for ascertaining, at contractor facilities and in the field, the modulation transfer characteristics of optical systems being developed for many kinds of exploitation equipment.		
14. TYPE OF WORK TO BE DONE Applied research -- engineering development		
15. CATEGORIES OF EFFORT		
MAJOR CATEGORY	SUB-CATEGORIES	
Special Techniques and Studies	Optical Systems	
16. END ITEM OR SERVICES FROM THIS CONTRACT/IMPROVEMENT OVER CURRENT SYSTEM, EQUIPMENT, ETC. Production instrument--capable of measuring spatial frequencies in excess of 1000 1/mm and to an accuracy, over an entire system's range, of 5% in both phase and amplitude: A considerable improvement over present techniques based on use of USAF 228 1/mm test targets. Instrument will weigh less than 5 lbs., (cont'd)		
17. SUPPORTING OR RELATED CONTRACTS (Agency & Other)/COORDINATION Liaison with AF and Navy personnel concerned with the development of optical instrumentation revealed no similar effort in the community. When prototype is completed, other interested agencies and components will be notified for purposes of joint procurement.		
18. DESCRIPTION OF INTELLIGENCE REQUIREMENT AND DETAILED TECHNICAL DESCRIPTION OF PROJECT (Continue on additional page if required)  In development of complex optical viewing equipment, field evaluation by the technical monitors is vital: this instrument will provide a means for checking on contractor performance and will serve to point out design and fabrication flaws in the early stages -- before a redesign or retro-fit becomes prohibitive.  A two-phase program was originally proposed. The first phase was an investigation and study of the basic parameters, as well as mechanical and optical (cont'd)		
19. APPROVED BY AND DATE		
DEPUTY DIRECTOR	DDCI	

Declass Review by NIMA/DOD

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16. (continued)  
with a volume of approximately 0.125 cubic ft.
18. (continued)  
design considerations. This phase terminated with an instrument design and a breadboarded feasibility demonstration. No prototype instrument was to be considered, since the contractor felt he would have provided sufficient basis for a final design on a production instrument. The second phase was to furnish as many instruments as required, on a fixed-price contract.

This R&D Catalog constitutes a re-direction of the original effort to provide a different and more efficient way to test viewer response. The present breadboard design, although perfectly suited for most tests, has the disadvantage that when one wants to test film viewers a partial dismantling of the viewer is required. This is due to the fact that the earlier proposed method was based on a variable contrast target which has to be inserted in the film plane. Although this variable target can be minimized in size, it will never be as thin as a single sheet of film. During the period of testing the principles and design of the proposed test equipment, a method was discovered whereby it is possible to modify the principle upon which the test is based to such an extent that only a target film is needed in the film plane, while the rest of the required test equipment can be on the image side.

This re-direction will also call for the contractor to supply targets that have a frequency range of one 1/mm to 1,000 1/mm in order to make the sine-wave tester as versatile as possible. The contractor will supply single targets encompassing the full frequency range. Each target will have three groups.

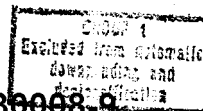
- Group 1: One 1/mm up to and including 10 1/mm
- Group 2: 10 1/mm up to and including 100 1/mm
- Group 3: 100 1/mm up to and including 1000 1/mm

Two consecutive targets will have a frequency ratio of 1:1.26. Each target will have a definite position with respect to the next lower one, so as to enable the measurement of the phase of the transfer function of the equipment under test.

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Although [REDACTED] being asked to re-direct their major efforts, the original concept of a laboratory instrument will still be pursued and they will supply NPIC with the original breadboard instrument contracted for; this instrument measures MTF under laboratory conditions.

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R & D CATALOG FORM

DATE

5 January 1965

1. PROJECT TITLE/CODE NAME Sine-Wave Testing Equipment		2. SHORT PROJECT DESCRIPTION The project involves the development of a device for field measurements of optical system performance.	
3. CONTRACTOR NAME [REDACTED]		4. LOCATION OF CONTRACTOR [REDACTED]	
5. CLASS OF CONTRACTOR R&D Company		6. TYPE OF CONTRACT CPIF (Cost and performance incentives)	
7. FUNDS FY 19 65 [REDACTED] FY 19 66 [REDACTED] FY 19      \$		8. REQUISITION NO. 8506-65	9. BUDGET PROJECT NO. NP-S-4
		10. EFFECTIVE CONTRACT DATE (Begin - end) 12/15/64 to 12/15/65	11. SECURITY CLASS. Agency Assoc.: Conf. Title - Uncl. Work - Uncl.
12. RESPONSIBLE DIRECTORATE/OFFICE/PROJECT OFFICER TELEPHONE EXTENSION DDI/NPIC/P&DS [REDACTED] /3308      25X1A			
13. REQUIREMENT/AUTHORITY      A portable device of high precision is needed by P&DS technical monitors for ascertaining, at contractor facilities and in the field, the modulation transfer characteristics of optical systems being developed for many kinds of exploitation equipment.			
14. TYPE OF WORK TO BE DONE Applied research -- engineering development.			
15. CATEGORIES OF EFFORT			
MAJOR CATEGORY Special Techniques and Studies		SUB-CATEGORIES Optical Systems	
16. END ITEM OR SERVICES FROM THIS CONTRACT/IMPROVEMENT OVER CURRENT SYSTEM, EQUIPMENT, ETC. Production instrument -- capable of measuring spatial frequencies in excess of 1000 1/mm and to an accuracy, over an entire system's range, of 5% in both phase and amplitude: A considerable improvement over present techniques based on use of USAF 228 1/mm test targets. Instrument will weigh less than 5 lbs., with a volume of approximately 0.5125 cubic ft.			
17. SUPPORTING OR RELATED CONTRACTS (Agency & Other)/COORDINATION Liaison with AF and Navy personnel concerned with the development of optical instrumentation revealed no similar effort in the community. When prototype is completed, other interested agencies and components will be notified for purposes of joint procurement.			
18. DESCRIPTION OF INTELLIGENCE REQUIREMENT AND DETAILED TECHNICAL DESCRIPTION OF PROJECT (Continue on additional page if required)  In development of complex optical viewing equipment, field evaluation by the technical monitors is vital: this instrument will provide a means for checking on contractor performance and will serve to point out design and fabrication flaws in the early stages -- before a redesign or retro-fit becomes prohibitive.  A two-phase program has been proposed. The first phase is an investigation and study of the basic parameters, as well as mechanical and optical design considerations. This phase terminates with an instrument design (Cont'd)			
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18.

and a breadboarded feasibility demonstration. No prototype instrument will be considered, since the contractor feels he will have provided sufficient basis for a final design on a production instrument. The second phase will furnish as many instruments as required, on a fixed-price contract.

The contractor proposes, paradoxically enough, to utilize 3-bar USAF-type targets in the measurement of modulation transfer function (MTF). The unit will be provided with a variable contrast control to determine the frequency at which contrast becomes extinct. This thus incorporates the most useful feature of bar-targets -- it forms the basis for yes/no judgments within fairly close limits. The frequency/contrast data are then converted, through a computer program, into the response which would be obtained were a sine-wave actually used, and thence to MTF. For field measurements, it will be possible to make manual computations of less precision but of approximately equal validity, through nomographs. The contractor has supplied a detailed analysis of his technique and indicates the precision of measurement, allowable errors in contrast adjustment, problems of phase error, and the mathematical basis for the techniques of modulation transfer measurements.

He proposes to investigate the influence of target imperfections as well as improvements in measurement techniques. He will design and fabricate the necessary optics and optical elements, and construct a breadboard to confirm the final design and measuring procedures. Following the necessary theoretical studies and experimental verifications, a basic design for the production instrument will be developed.

Based on the design of the equipment already developed, it is estimated that the testing device will weigh less than five pounds and be contained in a volume of approximately 0.125 ft<sup>3</sup>. Its transfer function will be unity over the range of operation, the upper frequency limit of which is estimated to be 1020 lines/mm. As newer, higher-frequency targets are received, they will be capable of insertion into this device. It will operate with a self-contained light source which is removable for inserting the test unit into the object plane of a projection system.

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